

CM 1 WHAT IS CLAIMED IS:

2 *sub Q1* 1. An improved prosthetic joint of the type
3 including:

4 a) tibial platform means having a first
5 superior bearing surface, the tibial platform
6 means for replacing tibial portions of a knee;
7 b) bearing insert means having a first
8 inferior bearing surface which slidably
9 engages the first superior bearing surface of
10 the tibial platform means, the bearing insert
11 means for providing an articulated joint
12 between the tibial platform means and femoral
13 portions of the knee;

14 wherein the improvement comprises:

15 c) the tibial platform means comprises track
16 means, the track means for constraining motion
17 of the bearing insert means relative to the
18 *sub Q3* tibial platform means.

19 2. An improved prosthetic joint as recited in Claim
20 1, wherein the track means comprises a curved track.

21 3. An improved prosthetic joint as recited in Claim
22 1, wherein the track means comprises a circular curved
23 track.

24 4. An improved prosthetic joint of the type
25 including:

26 a) tibial platform means having a first
27 superior bearing surface, the tibial platform
28 means for replacing tibial portions of a knee;
29 b) bearing insert means having a first
30 inferior bearing surface which slidably
31 engages the first superior bearing surface of
32 the tibial platform means, the bearing insert
33 means having a second superior bearing surface,
34 the bearing insert means for providing an
35 articulated joint between the tibial platform
36 means and a femoral component means, and,

1 c) femoral component means having a second
2 inferior bearing surface which slidably engages
3 the second superior bearing surface of the
4 bearing insert means, the femoral component
5 means for replacing femoral portions of the
6 knee;

7 wherein the improvement comprises:

8 d) the tibial platform means comprises track
9 means, the track means for constraining motion
10 of the bearing insert means relative to the
11 *sub 25* tibial platform means.

12 5. An improved prosthetic joint as recited in
13 Claim 4, wherein the track means comprises a curved track.

14 6. An improved prosthetic joint as recited in
15 Claim 4, wherein the track means comprises a circular
16 curved track.

17 7. An improved prosthetic joint as recited in
18 Claim 1, further comprising retention means, the retention
19 means for preventing dislocation of the bearing insert
20 means from the track means of the tibial platform means.

21 8. An improved prosthetic joint as recited in Claim
22 7, wherein the retention means comprises:

23 a) portions of the bearing insert means defin-
24 ing a dovetail projection; and,

25 b) portions of the track means of the tibial
26 platform means defining a complementary dovetail
27 cross-section within which the dovetail
28 projection is slidably retained.

29 9. An improved prosthetic joint of the type
30 including:

31 a) tibial platform means having a first
32 superior bearing surface, the tibial platform
33 means for replacing tibial portions of a first
34 condylar articulation of a knee;

35 b) bearing insert means having a first
36 inferior bearing surface which slidably

1 engages the first superior bearing surface
2 of the tibial platform means, the bearing insert
3 means having a second superior bearing surface,
4 the bearing insert means for providing an
5 articulated joint replacing the first condylar
6 articulation of the knee;
7 c) femoral component means having a second
8 inferior bearing surface which slidably engages
9 the second superior bearing surface of the
10 bearing insert means, the femoral component
11 means for replacing femoral portions of the
12 first condylar articulation of the knee; and,
13 d) wherein the knee includes a second condylar
14 articulation including a third, substantially
15 spherical concave, superior bearing surface,
16 which slidably engages a third, substantially
17 spherical convex, inferior bearing surface;
18 e) wherein the third, substantially spherical
19 concave, superior bearing surface defines a
20 first center of curvature;
21 wherein the improvement comprises:
22 f) the tibial platform means comprises circular
23 curved track means for constraining motion
24 of the bearing insert means relative to the
25 tibial platform means;
26 g) wherein the circular curved track means
27 lies within a first plane and has a second
28 center of curvature, thereby defining a first
29 axis perpendicular to the first plane and
30 passing through the second center of curvature;
31 and,
32 h) wherein the first axis passes through the
33 first center of curvature of the third,
34 substantially spherical concave, superior
35 bearing surface of the second condylar articulation.
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10. An improved prosthetic joint of the type including:
- a) first tibial platform means having a first superior bearing surface, the first tibial platform means for replacing tibial portions of a first condylar articulation of a knee;
 - b) second tibial platform means having a second superior bearing surface, the second tibial platform means for replacing tibial portions of a second condylar articulation of the knee;
 - c) first bearing insert means having a first inferior bearing surface which slidably engages the first superior bearing surface of the first tibial platform means, the first bearing insert means having a third superior bearing surface, the first bearing insert means for providing a first articulated joint replacing the first condylar articulation of the knee;
 - d) second bearing insert means having a second inferior bearing surface which slidably engages the second superior bearing surface of the second tibial platform means, the second bearing insert means having a fourth superior bearing surface, the second bearing insert means for providing a second articulated joint replacing the second condylar articulation of the knee;
 - e) first femoral component means having a third inferior bearing surface which slidably engages the third superior bearing surface of the first bearing insert means, the first femoral component means for replacing femoral portions of the first condylar articulation of the knee; and,
 - f) second femoral component means having a fourth inferior bearing surface which slidably

1 engages the fourth superior bearing surface of
2 the second bearing insert means, the second
3 femoral component means for replacing femoral
4 portions of the second condylar articulation of
5 the knee;

6 wherein the improvement comprises:

7 g) the first tibial platform means comprises
8 first track means, the first track means for
9 constraining motion of the first bearing insert
10 means relative to the first tibial platform
11 means; and,

12 h) the second tibial platform means comprises
13 second track means, the second track means for
14 constraining motion of the second bearing
15 insert means relative to the second tibial
16 platform means.

17 11. An improved prosthetic joint as recited in
18 Claim 10, wherein:

19 a) the first track means of the first tibial
20 platform means comprises a first curved track;
21 and,

22 b) the second track means of the second tibial
23 platform means comprises a second curved track.

24 12. An improved prosthetic joint as recited in
25 Claim 10, wherein:

26 a) the first track means of the first tibial
27 platform means comprises a first circular curved
28 track; and,

29 b) the second track means of the second tibial
30 platform means comprises a second circular
31 curved track.

32 13. An improved prosthetic joint as recited in
33 Claim 10, further comprising bridge means connecting the
34 first tibial platform means and the second tibial platform
35 means, the bridge means for improving accuracy of place-
36 ment of the first tibial platform means relative to the

1 second tibial platform means, the bridge means also for
2 sharing mechanical loads between the first tibial plat-
3 form means and the second tibial platform means while
4 permitting retention of cruciate ligaments.

5 14. An improved prosthetic joint of the type
6 including:

- 7 a) tibial platform means having a first
8 superior bearing surface, the tibial platform
9 means for replacing tibial portions of a knee;
10 b) bearing insert means having a first inferior
11 bearing surface which slidably engages the
12 first superior bearing surface of the tibial
13 platform means, the bearing insert means having
14 a second superior bearing surface, the bearing
15 insert means for providing an articulated
16 joint between the tibial platform means and a
17 femoral component means; and,
18 c) femoral component means having a second
19 inferior bearing surface which slidably engages
20 the second superior bearing surface of the
21 bearing insert means, the femoral component
22 means for replacing femoral portions of the knee;

23 wherein the improvement comprises:

- 24 d) the second inferior bearing surface of the
25 femoral component means comprises a plurality
26 of surface segments defined by rotating a
27 common plane generating curve about a plurality
28 of parallel axes of rotation.

29 15. An improved prosthetic joint as recited in
30 Claim 14, wherein;

- 31 a) the second inferior bearing surface of the
32 femoral component means comprises a first
33 surface segment defined by rotating the
34 common plane generating curve about a first axis;
35 b) the second inferior bearing surface of the
36 femoral component means also comprises a second

1 surface segment defined by rotating the common
2 plane generating curve about a second axis;
3 c) wherein the first surface segment and the
4 second surface segment adjoin to form an
5 intersection; and,
6 d) wherein the second axis lies in a plane
7 containing the first axis and a point on the
8 intersection producing a smooth continuous
9 bearing surface.

10 16. An improved prosthetic joint as recited in
11 Claim 14, wherein:

12 a) a radius of curvature, defined by a
13 distance from a given point on the common plane
14 generating curve to successive axes of the
15 plurality of parallel axes of rotation, is
16 monotonically decreasing for surface segments
17 ranging from anterior to posterior;
18 b) whereby full flexion of the prosthetic
19 joint is facilitated.

20 17. An improved prosthetic joint as recited in
21 Claim 1, wherein the bearing insert means is of non-
22 circular platform, thereby providing a prosthetic joint
23 having superior load-bearing characteristics and improved
24 stability.

25 18. An improved prosthetic joint as recited in
26 Claim 10, wherein:

27 a) the third inferior bearing surface of the
28 first femoral component means is slightly
29 incongruent with the third superior bearing
30 surface of the first bearing insert means;
31 b) thereby accommodating anterior-posterior
32 shift of the first bearing insert means relative
33 to the first tibial platform means, and thereby
34 facilitating flexion and rotation of the
35 prosthetic joint.

36 19. An improved prosthetic joint as recited in

1 Claim 18, wherein:

2 a) incongruency between the third inferior
3 bearing surface of the first femoral component
4 means and the third superior bearing surface of
5 the first bearing insert means is characterized
6 *Q11* by a congruency ratio between 0.90 and 1.00.

7 20. An improved prosthetic joint of the type
8 including:

9 a) platform means having a first bearing sur-
10 face, the platform means for being secured to
11 a first bone of an anatomical joint;
12 b) bearing insert means having a second bearing
13 surface which slidably engages the first bearing
14 surface of the platform means, the bearing
15 insert means for providing an articulated
16 joint between the platform means and portions
17 of the anatomical joint associated with a
18 second bone;

19 wherein the improvement comprises:

20 c) the platform means comprises track means,
21 the track means for constraining motion of the
22 bearing insert means relative to the platform
23 *Q13* means.

24 21. An improved prosthetic joint as recited in
25 Claim 20, wherein the track means comprises a curved
26 track.

27 22. An improved prosthetic joint as recited in
28 Claim 20, wherein the track means comprises a circular
29 curved track.

30 23. An improved prosthetic joint of the type
31 including:

32 a) platform means having a first bearing
33 surface, the platform means for being secured
34 to a first bone of an anatomical joint;
35 b) bearing insert means having a second bearing
36 surface which slidably engages the first bearing

1 surface of the platform means, the bearing
2 insert means having a third bearing surface,
3 the bearing insert means for providing an
4 articulated joint between the platform means and
5 a second bone component means; and,
6 c) second bone component means having a fourth
7 bearing surface which slidably engages the
8 third bearing surface of the bearing insert
9 means, the second bone component means for
10 being secured to a second bone of the anatomical
11 joint;

12 wherein the improvement comprises:

13 d) the platform means comprises track means,
14 the track means for constraining motion of the
15 bearing insert means relative to the platform
16 means.

17 24. An improved prosthetic joint as recited in
18 Claim 23, wherein the track means comprises a curved track.

19 25. An improved prosthetic joint as recited in
20 Claim 23, wherein the track means comprises a circular
21 curved track.

22 26. An improved prosthetic joint as recited in
23 Claim 20, further comprising retention means, the re-
24 tention means for preventing dislocation of the bearing
25 insert means from the track means of the platform means.

26 27. An improved prosthetic joint as recited in
27 Claim 26, wherein the retention means comprises:

28 a) portions of the bearing insert means
29 defining a dovetail projection; and,

30 b) portions of the track means of the platform
31 means defining a complementary dovetail cross-
32 section within which the dovetail projection is
33 slidably retained.

34 28. An improved prosthetic joint of the type
35 including:

36 a) platform means having a first bearing

1 surface, the platform means for being secured
2 to a first bone of an anatomical joint;
3 b) bearing insert means having a second
4 bearing surface which slidably engages the
5 first bearing surface of the platform means,
6 the bearing insert means having a third bearing
7 surface, the bearing insert means for providing
8 a first articulated joint between the platform
9 means and a second bone component means;
10 c) second bone component means having a fourth
11 bearing surface which slidably engages the third
12 bearing surface of the bearing insert means, the
13 second bone component means for being secured
14 to a second bone of the anatomical joint;
15 d) wherein the anatomical joint includes a
16 second articulated joint including a fifth,
17 substantially spherical concave bearing surface,
18 which slidably engages a sixth, substantially
19 spherical convex bearing surface;
20 e) wherein the fifth, substantially spherical
21 concave, bearing surface defines a first
22 center of curvature;
23 wherein the improvement comprises:
24 f) the platform means comprises circular
25 curved track means for constraining motion of
26 the bearing insert means relative to the
27 platform means;
28 g) wherein the circular curved track means
29 lies within a first plane and has a second
30 center of curvature, thereby defining a first
31 axis perpendicular to the first plane and
32 passing through the second center of curvature;
33 and,
34 h) wherein the first axis passes through
35 a point near the first center of curvature of
36 the fifth, substantially spherical concave,

See A17 bearing surface ~~of~~ the second articulated joint.
29. An improved prosthetic joint of the type
including:
a) first platform means having a first bearing surface, the first platform means for being secured to a first bone of an anatomical joint;
b) second platform means having a second bearing surface, the second platform means for being also secured to the first bone of the anatomical joint;
c) first bearing insert means having a third bearing surface which slidably engages the first bearing surface of the first platform means, the first bearing insert means having a fourth bearing surface, the first bearing insert means for providing a first articulated joint between the first platform means and a first component means;
d) second bearing insert means having a fifth bearing surface which slidably engages the second bearing surface of the second platform means, the second bearing insert means having a sixth bearing surface, the second bearing insert means for providing a second articulated joint between the second platform means and a second component means;
e) first component means having a seventh bearing surface which slidably engages the fourth bearing surface of the first bearing insert means, the first component means for being secured to a second bone of the anatomical joint;
f) second component means having an eighth bearing surface which slidably engages the sixth bearing surface of the second bearing insert means, the second component means for

1 being also secured to the second bone of the
2 anatomical joint;

3 wherein the improvement comprises:

4 g) the first platform means comprises first
5 track means, the first track means for constrain-
6 ing motion of the first bearing insert means
7 relative to the first platform means; and,

8 h) the second platform means comprises second
9 track means, the second track means for
10 constraining motion of the second bearing insert
11 means relative to the second platform means.

12 30. An improved prosthetic joint as recited in

13 Claim 29, wherein:

14 a) the first track means of the first platform
15 means comprises a first curved track; and,

16 b) the second track means of the second
17 platform means comprises a second curved track.

18 31. An improved prosthetic joint as recited in

19 Claim 29, wherein:

20 a) the first track means of the first platform
21 means comprises a first circular curved track;
22 and,

23 b) the second track means of the second
24 platform means comprises a second circular
25 curved track.

26 32. An improved prosthetic joint as recited in

27 Claim 29, further comprising bridge means connecting the
28 first platform means and the second platform means, the
29 bridge means for improving accuracy of placement of the
30 first platform means relative to the second platform
31 means, for sharing force loads between the first platform
32 means and the second platform means, and for permitting
33 retention of anatomical tissue.

34 33. An improved prosthetic joint of the type
35 including:

36 a) platform means having a first bearing

1 surface, the platform means for being secured
2 to a first bone of an anatomical joint;
3 b) bearing insert means having a second bearing
4 surface which slidably engages the first bearing
5 surface of the platform means, the bearing
6 insert means having a third bearing surface,
7 the bearing insert means for providing an
8 articulated joint between the platform means and
9 a second bone component means; and,
10 c) second bone component means having a fourth
11 bearing surface which slidably engages the
12 third bearing surface of the bearing insert
13 means, the second bone component means for
14 being secured to a second bone of the anatomical
15 joint;
16 wherein the improvement comprises:
17 d) the fourth bearing surface of the second
18 bone component means comprises a plurality of
19 surface segments defined by rotating a common
20 plane generating curve about a plurality of
21 parallel axes of rotation.
22 34. An improved prosthetic joint as recited in
23 Claim 33, wherein:
24 a) the fourth bearing surface of the second
25 bone component means comprises a first surface
26 segment defined by rotating the common plane
27 generating curve about a first axis;
28 b) the fourth bearing surface of the second
29 bone component means also comprises a second
30 surface segment defined by rotating the common
31 plane generating curve about a second axis;
32 c) wherein the first surface segment and
33 second surface segment adjoin to form an inter-
34 section; and,
35 d) wherein the second axis lies in a plane
36 containing the first axis and a point on the

1 intersection producing a smooth continuous
2 bearing surface.

3 35. An improved prosthetic joint as recited in
4 Claim 33, wherein:

5 a) a radius of curvature, defined as a distance
6 from a given point on the common plane generat-
7 ing curve to successive axes of the plurality
8 of parallel axes of rotation, is monotonically
9 decreasing for surface segments ranging from
10 anterior to posterior;
11 b) whereby full flexion of the prosthetic
12 joint is facilitated.

13 36. An improved prosthetic joint as recited in
14 Claim 20, wherein the bearing insert means is of non-
15 circular platform, thereby providing a prosthetic joint
16 having superior load-bearing characteristics and improved
17 stability.

18 *sub A2037* 37. An improved prosthetic joint as recited in
19 Claim 29, wherein:

20 a) the seventh bearing surface of the first
21 component means is slightly incongruent with
22 the fourth bearing surface of the first bearing
23 insert means;
24 b) thereby accommodating motion of the first
25 bearing insert means relative to the first
26 platform means, and thereby facilitating
27 flexion and rotation of the prosthetic joint.

28 38. An improved prosthetic joint as recited in
29 Claim 37, wherein:

30 a) incongruency between the seventh bearing
31 surface of the first component means and the
32 fourth bearing surface of the first bearing
33 insert means is characterized by a congruency
34 ratio between 0.90 and 1.00.

35 *sub A21* 39. An improved prosthetic joint according to
36 Claims 20, 21, 22, 23, 24, 25, 26, 27, 33, 34, 35 or 36,

1 wherein the anatomical joint is an ankle, the first bone
2 is a talus, and the second bone is a tibia.

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5 a18 xa22

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